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APPENDIX I

Fixing element of a unit for a motor vehicle

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to a fixing element of a unit for a motor vehicle for fixing a drive train to a frame of the motor vehicle. The invention relates in particular to a fixing element of a transmission, which has a mounting for the transmission, in order to dampen or weaken moments and forces which occur and can be produced by the unit, in a specific manner in relation to the frame of the vehicle.

For engines and transmissions, it is sufficiently known in the motor vehicle industry to fix the fixing elements on the body in a vibration-reducing manner via mountings. In this case, there is the problem of sufficiently fixedly positioning and fixing the position of the engine or the transmission and nevertheless of avoiding the transmission of vibrations and forces to the vehicle frame or the vehicle body as far as possible. Too great a transmission of moments and forces to the frame of a vehicle has the disadvantage, firstly, of a noticeable vibration or shaking in the vehicle and therefore of reduced comfort.

Secondly, the frame parts of the vehicle have to be of correspondingly stiff design in order to be able to absorb the moments and forces. This, however, leads to an increase in the overall weight of the vehicle. To avoid transmission of forces to the vehicle frame, complicated transmission holding devices have been developed which, by means of elastic elements, permit a damped mounting with respect to the vehicle body.

These damping or mounting elements for fixing transmissions or transmission trains of a vehicle have for this purpose spring-elastic bearings which are mounted between a securing strut running transversely with respect to the longitudinal axis of the vehicle and the longitudinal members of the vehicle frame.

The mounting member for the transmission is mounted fixedly on the longitudinal members of the vehicle frame, and it therefore transmits the vibrations, forces and moments that are not damped by the bearing elements directly to the frame of the vehicle. In particular when there is an increased moment stress, this leads to the longitudinal members being able to be loaded locally with a greatly increased torsional stress.

Such an energy-absorbing fixing or mounting system for a transmission of a vehicle is known, for example, from GB 2 204 839 A. A crossmember connected to the transmission is connected fixedly here to respective longitudinal members of a vehicle frame. On the transmission side, rubber-elastic bearing elements are provided which, owing to their deformability, permit a certain weakening and damping of forces and vibrations occurring in the transmission.

A disadvantage in this known case is that the crossmembers on the transmission train are connected fixedly to the longitudinal members, so that moments which occur inevitably lead to a torsional stress on the fixing points of the crossmembers. The central mounting between the transmission itself and a crossmember provided here, however, permits a slight reduction in the vibrations and forces transmitted. An effective mounting without excessive stress on the

frame of the vehicle is not possible. In addition, transmission holding crossmembers in addition to the vehicle body crossmembers which are present in any case are required. A considerable amount of space is thus required for this known mounting and in each case separate fixing means and connecting elements for the transmission holder or crossmembers of the body.

DE 43 25 598 A1 discloses a transmission supporting means in which a transmission holder, which is configures as a crossmember element, is mounted on the vehicle frame by rubber-metal bearings. This additional transmission support is provided next to the actual transmission mounting and the crossmembers for reinforcing the vehicle frame itself. In this case, the additional transmission support is configured such that torques of the transmission can be effectively absorbed and supported by the rubber-metal bearings having a line of action aligned with the axis of rotation of the transmission. One disadvantage in this case is the considerably increased outlay on installation and parts for this additional transmission support and mounting. In addition, only a mounting coordinated with the moments of the transmission train can take place with this strut-like transmission support. The vertical and horizontal forces of the transmission are hardly absorbed or damped.

By contrast, an subject of the present invention is to produce a fixing element of a unit for a motor vehicle, in which the unit permits an effective mounting with respect to horizontal and vertical forces which occur and to moments of a unit, in addition to a reduced outlay on parts and improved effectiveness of the damping even in limited construction space situations.

The foregoing object has been achieved by providing a fixing element of a unit for a motor vehicle for fixing a drive train or a unit to a frame or body part of the motor vehicle which has a unit holder on which the drive train is fixedly mounted, and at least one crossmember for reinforcing the vehicle frame. Furthermore, the fixing element of a unit has a mounting for the mounting of the drive train with respect to the body of the vehicle, and the at least one crossmember and the unit holder are coupled to each other via the mounting and being fixed as a composite construction to the vehicle frame of the motor vehicle so that moments resulting from the drive train can be compensated for by the crossmember. In this manner, a highly effective support and mounting element for a drive train of a vehicle is provided, in which the element avoids introducing moments into the frame of the vehicle body.

The coupling of crossmember and unit holder via the mounting which, for its part, is fixed fixedly to the vehicle frame permits moments which originate from the drive train to be introduced and absorbed by the crossmember which is specifically configured in this regard. There is no direct connection between the crossmember and longitudinal member of the vehicle body. In the present case, unit is understood as meaning in particular a transmission, an engine, a retarder or similar component of a drive train.

A local loading of the longitudinal members of the vehicle frame by torsional stress on a fixed fixing point is avoided with the present invention. The torques resulting from the drive train or the unit of the vehicle are no longer absorbed on the frame but rather are absorbed in the fixing element according to

the invention via the composite construction of crossmember and unit holder. The mounting is nevertheless simple in configuration and does not require any complicated torsion bearings or complex mounting systems.

The at least one crossmember absorbs the moments of the drive train, so that only longitudinal, transverse and vertical forces are introduced via the unit holder and the bearings into the frame of the vehicle body. A torsional stress of the longitudinal members therefore does not take place at all, and the longitudinal members are therefore subjected to less loading than previously.

In addition, the fixing element of a unit according to the invention, comprising a composite construction of a crossmember and a unit holder and also bearing elements, realizes a saving in space in the in any case very constricted region of the transmission of a vehicle. No additional parts and fixing elements are required for the crossmember of the body.

Furthermore, the fixing element of a unit according to the invention permits a variable fixing even of different subassemblies or body shapes, because a fixing and mounting on the body is possible independently of a crossmember mounted fixedly on the body. Nevertheless, the required rigidity of the body in the region of the unit is ensured. The fixing element of a unit according to the invention can be fixed directly to a longitudinal member of the vehicle frame at various positions, for example via conventional fixing apparatus on the bearings of the mounting, without complicated adaptations and

installation work being necessary in the case of different types of vehicle.

According to one advantageous refinement of the invention, the crossmember is of torsion-proof configuration in order to absorb moments with respect to a longitudinal axis of the motor vehicle and is fixed directly to the mounting. This ensures that moments are absorbed by the unit or drive train of an engine of a motor vehicle. The torsion-proof design of the at least one crossmember can take place, for example, via a corresponding profiled shape, such as, for example, an L-shape or U-shape, or else via a corresponding strength of the material and/or shape of the crossmembers.

The crossmembers may also have, for example, a slightly curved shape, so that the crossmembers provide a support which is favorable for moments. Of course, the crossmember is equally also provided in order to provide a transverse reinforcement of the vehicle body itself. For this purpose, the vertical movablility at the fixing points between the mounting elements and the crossmember itself is of correspondingly limited design.

The horizontal and vertical forces can equally be absorbed by the crossmember as can the drive train moments which are to be weakened and to be supported according to the invention. The fixing element of a unit according to the invention is therefore improved in its functionality in comparison to previously known elements of this type and makes it possible, by way of a simple and compact composite construction element, to combine the two functions of transverse reinforcement

of the vehicle body and a moment-absorbing mounting of the unit.

According to a further advantageous refinement of the invention, the at least one crossmember comprises two member parts which are connected at their ends to the side of and spaced apart from the unit holder itself to in each case two elastic bearing elements of the mounting. The bearing elements serve, on one hand, to connect the unit holder to the parts of the crossmember. On the other hand, the fixing element of a unit is fixed overall to a body part of the vehicle by the bearing elements. With a single fixing, the crossmember, like the unit holder, can thus be mounted on the vehicle. The number of parts and the outlay on installation are reduced. The crossmember parts which are arranged spaced apart and to the side of the unit holder permit a simple structural formation of the crossmember elements, for example by simple bending and forming processes. In addition, the fixing element of a unit is relatively light.

According to a still further advantageous refinement of the invention, the mounting of the fixing element of a unit comprises two elastic bearings which are mounted fixedly on the body and each have fixing openings for the crossmember and the unit holder. The fixing openings for the unit holder and the crossmember are in each case arranged, for example, approximately at right angles to each other and offset, so that the fixing of both subelements of the fixing element of a unit according to the invention can be mounted in one and the same elastic basic body.

The mounting is a fixed mounted on the body, for example via a bearing plate or a housing part of the

elastic bearing. The bearing may comprise a composite construction of metal plates and elastic materials, such as, for example, rubber or elastomeric plastics. The fixing and installation of the fixing element of a unit according to the invention can be realized by simple screw connections. The production of the fixing element of a unit according to the invention is relatively simple, because the bearings are simple elastic bearing elements.

According to yet a further advantageous refinement of the invention, the unit holder is a central, for example U-shaped, profiled beam which is suitable for transmitting moments and forces. The unit holder is provided, for example in its central region, with a flat fixing section and has openings or bores in each case at its ends for screwing to the mountings. In this case, the U-shape points downward, thus providing a beam-like, relatively stiff holder for the forces originating from the unit.

The forces and moments are transmitted by the unit directly to the U-shaped unit holder, and, at the bearing elements, the moments are transmitted to the crossmembers whereas only the longitudinal, transverse and vertical forces on the part of the unit are transmitted to the longitudinal members of the frame of the vehicle. This avoids a torsional loading on the fixing points of the fixing of the unit. Only innocuous longitudinal, transverse and vertical forces are still transmitted by the unit holder directly to the frame part of the vehicle body, albeit in weakened form owing to the elastic mounting of the bearing elements.

According to a further advantageous refinement of the invention, the unit holder of the fixing element of a unit is fixed in each case via in each case two fixing devices which are mounted in the vertical direction, via corresponding fixing openings of the mounting. In this manner, the unit holder firstly provides a fixed support in the vertical direction by resting on the lateral longitudinal members and by its vertically oriented fixing elements, such as, for example, screws. Secondly, a sufficient stability of the holder in transverse and longitudinal directions with respect to the longitudinal axis of the vehicle is ensured. Nevertheless, a moment support according to the invention with the fixing element of a unit is possible by way of the crossmember elements provided in addition and parallel to the unit holder.

According to a further advantageous refinement of the invention, the at least one crossmember of the fixing element of a unit is mounted on the mounting via in each case two fixing devices which are mounted in the horizontal direction, via corresponding fixing openings. By way of the two devices for fixing to the mounting, the crossmember element or the parts of the crossmember have the moment-absorbing property, since a rotation with respect to the bearing element, as would be present in the case of a fixing on just one axis, is avoided. A good absorption of moments by the unit via the unit holder and the mountings on the crossmember is therefore ensured.

According to a further advantageous refinement of the invention, the mounting comprises in each case block-like, elastic bearing elements with a respective housing or a fixing plate. The fixing plate has openings for a releasable installation on the vehicle

frame, for example four opening bores. Corresponding fixing screws can be screwed to the longitudinal member of the vehicle frame in the opening bores. The block-like configuration of the bearing elements from an elastic material, such as, for example, rubber, can be realized in any way known to the person skilled in the art. For example, a sheet-metal housing which is open on one side and has a base plate for the fixing of the mounting can be provided, in which housing one or more layers of elastic material are fitted. The connection of the layers of elastic material and metal plate can take place, for example, by adhesive bonding or any other techniques known to the person skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention are illustrated in the drawings and will be explained in detail in the following description.

Fig. 1 is a perspective view of an embodiment of a fixing element of a unit according to the present invention;

Figs. 2a,2b are each side views of the fixing element of the unit according to Fig. 1; and

Fig. 2c is a plan view of the fixing element of the unit from Fig. 1.

DETAILED DESCRIPTION OF THE DRAWINGS

The fixing element 10 of a unit according to the invention is in the embodiment shown here configured as a fixing element 10 of a transmission and, according to

Fig. 1, is configured with a two-part crossmember 2 comprising first and second crossmember parts 21, 22. Of course, it is contemplated that the invention may also be realized with just a single-part crossmember. The fixing element 10 of a transmission comprises a composite construction of a central transmission holder 1 and the L-shaped crossmember parts 21, 22 which are arranged in each case laterally thereto and are mounted together with the transmission holder 1 via bearing mountings 3, 4, which are explained in more detail with reference to Figs. 2a to 2c.

The bearings 3, 4 have fixing openings 11 by way of which they can be fixed in each case to a longitudinal member of a vehicle connectional frame (not illustrated). For this, the bearings 3, 4 each have a fixing plate which is of flat construction and points outward from the fixing element 10 of a transmission. Instead of the flat configuration of the fixing plate, it is also contemplated for the bearings 3, 4 to bear against the associated longitudinal member only in the region of the fixing openings 11. In this case, those points of the mounting 3, 4 which bear against the associated longitudinal member can protrude in raised form and can be situated in a plane or else offset with respect to one another. Furthermore, the bearings 3, 4 are provided with elastic materials, thus permitting a transmission of moments and forces and partial absorption.

In its central region, the transmission holder 1 has a flat section and fixing openings 12 for fixing a transmission (not illustrated). The transmission or the transmission train produces moments and forces during operation of the vehicle that are absorbed by the transmission holder 1 and passed on to the bearings

3, 4. According to the invention, the moments are absorbed by the crossmember 2 configured specifically for this purpose. In this manner, only transverse and longitudinal forces, but no moments, are transmitted to the lateral fixing sections of longitudinal members via the bearings 3, 4 by way of the fixing element 10 of a transmission according to the invention.

A local torsional stress on longitudinal members is thus avoided. In the illustrated embodiment, the crossmember parts 21, 22 have a slightly curved shape and an outwardly protruding, torsion-proof L shape. The crossmember parts 21, 22 are mounted on the respective, end-side bearings 3, 4 via in each case two horizontally arranged fixing screws 8, 9 per side of the bearing 3, 4 in the manner explained in more detail below with reference to Figs. 2a to 2c. Instead of the horizontally running fixing screws 8, 9, obliquely arranged screws would also be conceivable if the need arises.

The central, beam-like transmission holder 1 is, for its part, likewise mounted on the bearing 3, 4 via in each case two fixing screws 7 in the manner likewise explained in more detail below with reference to Figs. 2a to 2c, with the fixing screws 7 being arranged in a vertical direction - i.e. transversely with respect to the former fixing screws. An oblique profile of the screws 7 would also be utilizable here.

The transmission holder itself is configured so that it has sufficient rigidity to hold a transmission train, and, in this illustrated embodiment, it is configured as an essentially U-shaped beam with a flat, central region. As an alternative, it is also contemplated to use a connecting element composed of a plurality of

parts as the beam. By way of the direct connection of, on one hand, the crossmember 2 and the transmission holder 1 via bearings 3, 4 provided in each case at the end, a compact and highly effective holding and mounting element is provided. A transmission of moments from the transmission train is absorbed without them being introduced into the body.

The fixing element 10 of a transmission according to the invention is very compact in its construction and does not require any additional particular fixing elements for the crossmember 2 and the transmission holder 1 itself. The mounting 3, 4 serves for a common fixing of the crossmember 2 and of the transmission holder 1. The mounting in the case of the element according to the invention is extremely simple to realize from, for example, a mixed metal-rubber mounting. Any other type of bearing known to the person skilled in the art for the damping and mounting of transmissions and/or engines may also be suitable.

Figs. 2a, 2b and 2c reproduce respective side views and a plan view of the exemplary embodiment of the fixing element 10 of a transmission according to Fig. 1: the member parts 21, 22, which have a curved shape, are not connected directly to the longitudinal member of a frame of a vehicle but rather via the bearings 3, 4 of the transmission holder 1. For this purpose, the bearings 3, 4 have a fixing housing 13 which is open on one side and encloses elastic material layers 14 of the bearings 3, 4. The elastic layers 14 may be made, for example, of a rubber material or similar.

The fixing plate of the bearing housing 13 is provided on the rear side with in each case four fixing openings 11 by way of which the bearings 3, 4 can be

mounted on corresponding body parts of the vehicle frame. The two crossmember parts 21, 22 are secured on the side cheeks 15, 16 of the bearing housing 13, which side checks are arranged on opposite sides of the bearings 3, 4, via the in each case two fixing screws 8, 9.

In the illustrated embodiment, four fixing screws 8, 9 are therefore provided per bearing 3, 4 in order to fix the two crossmember parts 21, 22 to the bearing housing 13. It would likewise be within the scope of the present invention to use fixing screws 8, 9 which can be inserted through the elastic layers 14, so that two fixing screws 8, 9 are provided per bearing 3, 4. Likewise provided on the bearings 3, 4 are fixing screws 7 which are arranged transversely thereto and by way of which the transmission holder 1 is connected at its respective ends to the bearings 3, 4. For this purpose, the beam 1 is supported on the elastic layers 14 of the bearings 3, 4 and is not connected to the bearing housing 13.

To support the beam 1, the upper side of the elastic layer 14 on both bearings 3, 4 is provided with a supporting plate or the like, preferably made from a metal material, which is integrated in the elastic layer. In addition, threaded holes or the like for the fixing of the screws 7 are arranged on this supporting plate. In a very simple embodiment, the integration of the supporting plates in the elastic layers 14 of the two bearings 3, 4 may also be omitted. In this manner, moments which from a transmission train fixed to the transmission holder 1 via the fixing openings 12 are not transmitted to the vehicle frame but rather are absorbed by the bearings 3, 4.

By contrast, the crossmember parts 21, 22 are connected to the associated longitudinal members or other parts of the frame in an extremely stiff manner via the bearing housings 13 of the bearings 3, 4. The fixing element 10 of a transmission according to the invention is extremely compact and does not require any additional fixing elements and separate parts for mounting the transmission or reinforcing a vehicle frame. By way of the releasable fixing of the element and the taking on of a dual function, namely, firstly, of a transmission holder and mounting and, secondly, a reinforcement in the sense of a crossmember of a body, the variability in the fitting in different types of vehicle and with different dimensions is increased.

The fixing element 10 of a transmission according to the invention can be differently positioned and mounted in different types of vehicle in accordance with the particular position, for example via a series of fixing openings provided laterally on the longitudinal members of a vehicle frame. A complicated machining and installation for different types of vehicle with different dimensions in the transmission region of the vehicle body is thus avoided.

Of course, the present invention is not restricted to the illustrated embodiment. For example, the bearings 3, 4 can be replaced by another type of bearing and may be configured, for example, as combined metal bushings/rubber bearings or the like. Also, instead of two separate crossmember parts 21, 22, it is also possible to provide just a single crossmember which can be configured, for example, as a U-shaped crossmember surrounding the transmission holder. Instead of the fixing of a transmission, the present fixing element

may also be used for the fixing of an engine, a retarder or similar component of a drive train.

All of the features and elements illustrated in the description and in the drawing may be essential to the invention both on their own and in any desired combination with one another.